Leicestershire County Council

Leicestershire County Council

FLOOD INVESTIGATION REPORT

BRAMCOTE ROAD, LOUGHBOROUGH

1ST OCTOBER 2019

Final Report

November 2021

To discuss this report, please contact the Flood Risk Management Team by email flooding@leics.gov.uk or by phone 0116 305 0001

CONTENTS

1 EXECUTIVE SUMMARY

1.1 On the morning of 1st October 2019, a heavy rainfall event occurred with approximately 30mm of rain falling within a three-hour period (source: Mountsorrel rain gauge). Prior to the event, catchments located within central England were subject to prolonged rainfall resulting in heavily saturated soils. Unable to effectively infiltrate, the heavy rainfall event created significant volumes of surface water which flowed across the agricultural uplands and into the Moat Brook. The high volume of water caused the Moat Brook to breach its banks and resulted in flood water flowing onto Bramcote Road. This resulted in the internal flooding of five residential properties, external flooding to a further four residential properties, and also caused the highway and surface water drainage systems to be overwhelmed.

1.2 SUMMARY OF FLOOD SOURCES

Ordinary Watercourse	☑	**Public Sewer**	☐
Main River	☐	**Canal**	☐
Surface Water	☑	**Land Drainage**	☐
Groundwater	☐	**Highway Drainage**	☑

1.3 RECEPTORS IMPACTED (NUMBER)

Residential	Business	Other Buildings	Roads	Critical Infrastructure
5	0	0	1	0

2 INTRODUCTION

2.1 SECTION 19 INVESTIGATIONS – DUTY TO INVESTIGATE

Section 19 of the Flood and Water Management Act (FWMA) states:

(1) On becoming aware of a flood in its area, a Lead Local Flood Authority (LLFA) must, to the extent that it considers it necessary or appropriate, investigate:

a. which Risk Management Authorities (RMAs) have relevant flood risk management functions, and

b. whether each of those RMAs has exercised, or is proposing to exercise, those functions in response to a flood event.

(2) Where an authority carries out an investigation under section 1 (above) it must:

- *publish the results of its investigation, and*
- *notify any relevant RMAs."*

2.2 FORMAL FLOOD INVESTIGATIONS CRITERIA

Leicestershire County Council, from herein referred to as *"The Council",* identified local thresholds for formally investigating flood incidents across Leicestershire within the Local Flood Risk Management Strategy published in August 2015. This policy advises when a formal flood investigation should be undertaken, including where one or more of the thresholds in table 1 occurs as a result of a flooding incident.

A formal investigation into the flood incident on Bramcote Road, Loughborough on the 1st October 2019 has been undertaken as the event triggered the locally agreed flooding characteristics or discretionary items as indicated below:

Table 1: Locally Agreed Criteria for Formal Flood Investigations

Mandatory Investigation	
Loss of life or serious injury	☐
Critical infrastructure flooded or nearly flooded from unknown or multiple sources	☐
Internal property flooding from unknown or multiple sources	☑
Discretionary Investigation	
A number of properties have been flooded or nearly flooded	☐
Other infrastructure flooded	☐
Repeated instances	☐
Investigation requested	☐
Risk to health (foul water)	☐
Environmental or ecologically important site affected	☐
Depth/area/velocity of flooding a cause for concern	☐

2.3 RISK MANAGEMENT AUTHORITIES (RMAS)

The following RMAs were identified as relevant to the flooding in Bramcote Road, Loughborough:

- Leicestershire County Council – LLFA
- Leicestershire County Council – Local Highways Authority
- Charnwood Borough Council (CBC) - Local Planning Authority and Land Drainage Authority who can carry out flood risk management works on minor watercourses
- Severn Trent Water Ltd (STW) – Statutory undertaker for public wastewater and freshwater assets along Bramcote Road.

3 FLOOD INVESTIGATION

3.1 LOCATION AND SETTING

Bramcote Road is located to the southwest of Loughborough in Charnwood Borough. The area predominantly compromises residential properties, with a row of modern properties (constructed in the 1980s) on the eastern side of Bramcote Road, and a medieval Moat House on the western side of the road. The Moat House and features within its curtilage has Grade II listed building status. In the late 1980s, part of the Moat House's land was developed into a residential development of nine properties, known locally as the 'Moat House Development'.

Immediately south of Bramcote Road is the more modern Beck Crescent housing development which was completed in 2014 (Figure 1). As part of the development, a flood compensation area was created on the western side of the Moat Brook to compensate for the lost fluvial flood plain.

The residential properties that were affected by the flooding on 1st October 2019 are located in the Moat House Development on the western side of Bramcote Road. The residential properties are situated on level ground which is at or slightly above the Moat Brook top of bank level. The residential property threshold levels are set at or below the carriageway level of Bramcote Road, with unobstructed driveways or paths tipping any flood water directly towards the properties (Photo 1).

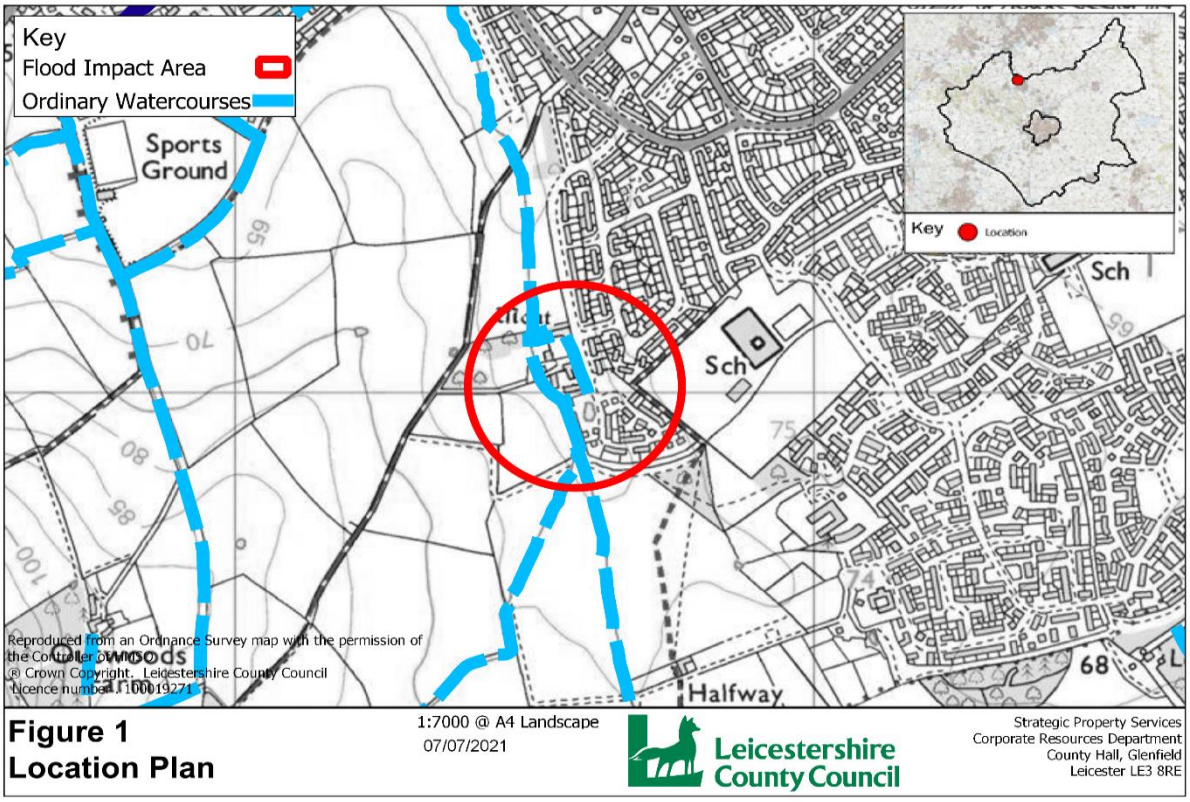
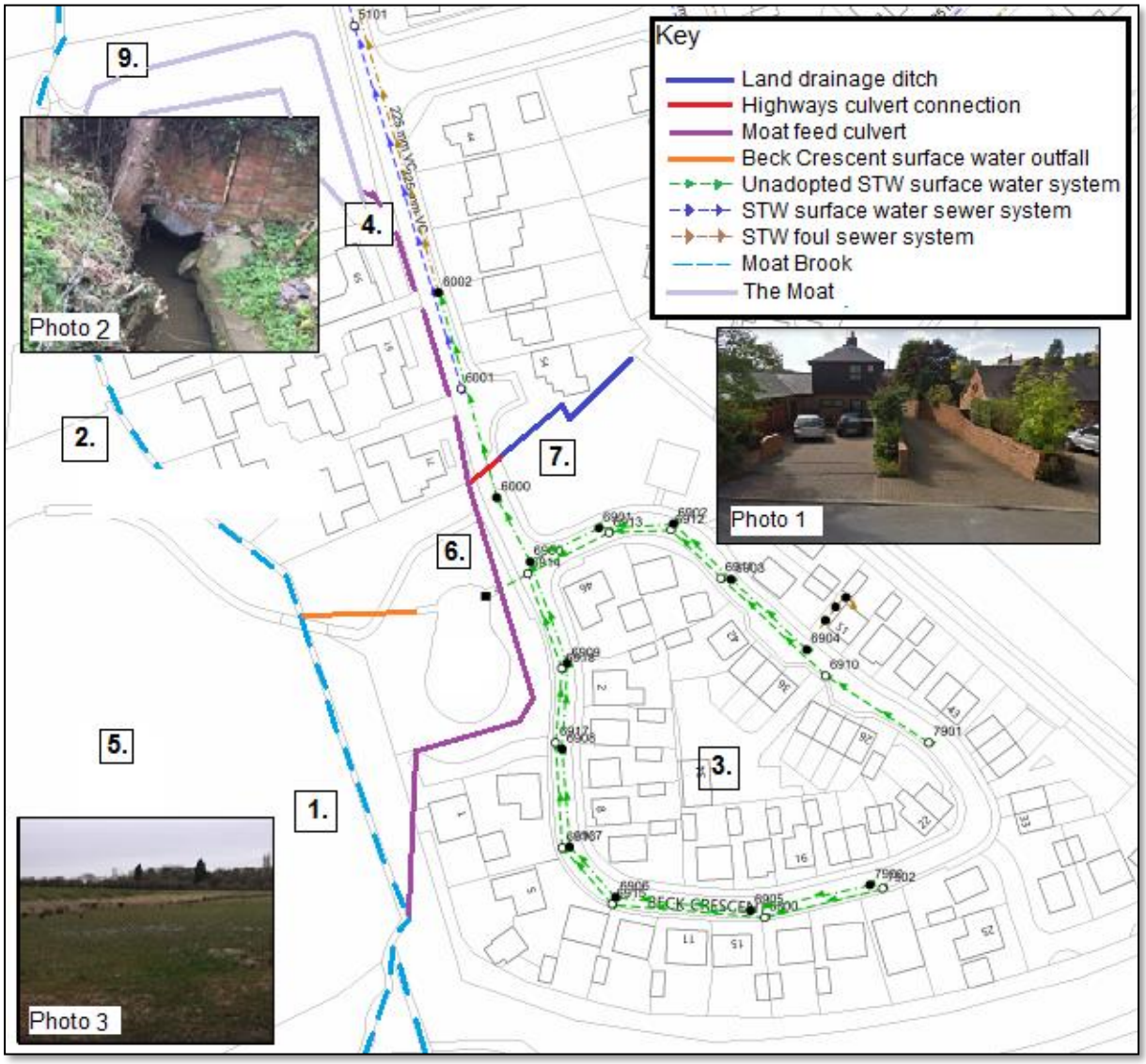


Figure 1: Location plan

3.2 LOCAL DRAINAGE

Figure 2 below illustrates all major drainage features in the surrounding area.

Figure 2: Major drainage features plan



Details regarding the major drainage features in relation to the affected area are discussed below:

1. Moat Brook: The Moat Brook is classified as an ordinary watercourse which flows from north of the Beck Crescent and Bramcote Road residential developments. The Moat Brook is owned and maintained along its course by multiple riparian landowners. The Moat Brook is a tributary of the Wood Brook, it has a standardised lowland fluvial profile, flowing in a north-westerly direction from the lowland hills south of Loughborough before joining the Wood Brook approximately 1km to the north of Bramcote Road. The headwaters upstream of Bramcote Road are steeper and thus the water flows quickly down towards the impacted area, where it flattens out and slows down. This creates a natural flood plain area which originally extended onto the

eastern side of the Moat Brook but was displaced by the Beck Crescent development. The flood compensation area was created to compensate for this. Due to the profile, the Moat Brook is prone to 'flash' fluvial flooding as high-velocity water flows down from the steeper farmland and slows down and bottlenecks adjacent to Bramcote Road and the Victorian footbridge.

2. Victorian Footbridge: A privately owned scheduled monument (Photo 2 in Figure 2). The footbridge culvert has an approximate diameter of 1250mm and is built into the Moat Brook House boundary wall. Water is unable to flow over or around the structure, creating a significant bottleneck.

3. Beck Crescent Surface Water Drainage System: The Beck Crescent system is separate from Bramcote Road. The hard-standing areas of Beck Crescent are served by gullies which drain into a STW surface water and foul systems (green arrowed line in Figure 2). This system connects into the attenuation pond for water to be stored and discharged at a rate lower than the greenfield runoff rate into the Moat Brook.

4. Bramcote Road Surface Water Drainage System: Bramcote Road is served by a STW public surface water sewer with highway road gullies on both sides of the road. The highway drainage system is sufficiently sized to intercept water which falls directly onto the highway in all but the most severe storm conditions but is not expected to intercept flows entering the highway from other sources.

5. Beck Crescent Flood Compensation Area: To offset the Flood Zone lost from the regrading of the land to facilitate the Beck Crescent development (Photo 3 in Figure 2), a compensation area was created to provide up to 442.9m^3 of flood storage capacity. This is a betterment of 326.6m^3 compared to pre-development volume.

6. Moat Brook House Moat Feed (Purple Line): A 225mm diameter culvert which takes water from the Moat Brook upstream of Beck Crescent to keep the moat watered. The original culvert line was diverted to facilitate the installation of the Beck Crescent attenuation pond.

7. Land Drainage Ditch & Highway Culvert (Dark Blue Line): This historic field ditch forms the boundary of the grassed area located to the north of the Beck Crescent Development. It now connects into the moat feed system via a 225mm diameter culvert.

8.The Wood Brook: The Moat Brook discharges into the Wood Brook (a designated Environment Agency Main River). Following the route of the Moat Brook, surrounding areas are categorised as Flood Zones 2 and 3 (Figure 3). As the Moat Brook discharges into the Wood Brook approximately 900m north of the flood impact area, the Moat Brook is likely to be hydraulically sensitive to (i.e. affected by) what is occurring in the Wood Brook.

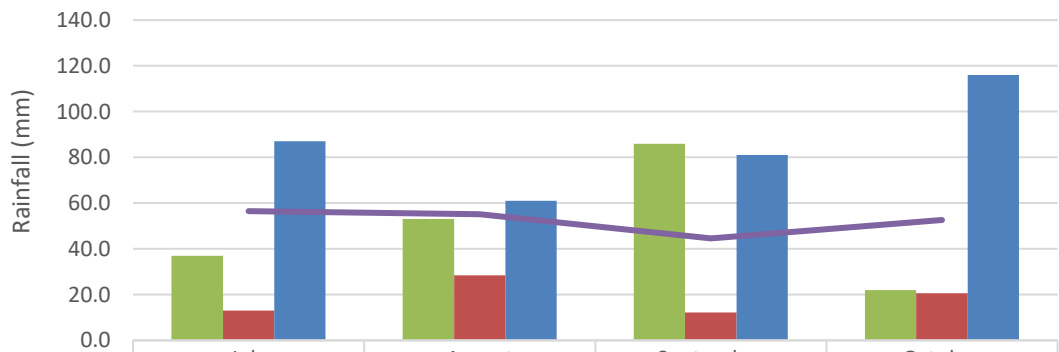
4 FLOODING INCIDENT ON 1ST OCTOBER 2019

4.1 PRIOR TO THE EVENT

A flood warning for the Wood Brook and River Soar at Loughborough was issued at 10:24am on the 1st October 2019, however the impacted residential properties are not located within this flood warning area and so the residents did not receive a prior warning. The Bramcote Road residents were also not part of any formal Flood Warden scheme and, as such, no emergency preparations would have been conducted meaning that there was limited preparedness by the residents prior to the flood event.

The rainfall analysis in Figure 3 illustrates that the Moat Brook was subjected to a prolonged period of above average rainfall in the months prior to the flood event on the 1st October 2019, with the previous three months rainfall all significantly above the 15-year averages. A number of other communities in Leicestershire were similarly impacted at this time. The Hydrological Summary (Rainfall) produced by the Centre for Ecology and Hydrology for October 2019 states:

'Since the start of summer (June-October), almost all of the UK received above average rainfall. A swathe of northern, central and eastern England registered 150% of average, with localised parts of the East Midlands receiving more than 170% of average. For England & Wales, in the last 50 years only the exceptional 2012 was wetter over the June-October timeframe.'



	July	August	September	October
2017	37.0	53.0	86.0	22.0
2018	13.0	28.4	12.2	20.6
2019	87.0	61.0	81.0	116.0
15 Year Average	56.5	55.2	44.6	52.7

Figure 3: Recorded rainfall data from the Mountsorrel rain gauge.

4.2 FLOOD EVENT

On the morning of 1st October 2019 there was a heavy rainfall event with approximately 30mm of rain within a three-hour period onto already saturated soils (Mountsorrel rain gauge located approximately 3-4 miles from Bramcote Road).

Unable to effectively infiltrate, the heavy rainfall event created significant volumes of surface water which flowed across the agricultural uplands and into the Moat Brook. This high volume of water caused the Moat Brook to breach its banks and result in flood water quickly filling the Flood Compensation Area.

The Victorian footbridge caused a significant bottleneck to the flow of the Moat Brook with flood water backing up to Bramcote Road and Beck Crescent. The ground profile along this boundary created a flow route onto Bramcote Road (see Figure 4).

This flood water then flowed around the Moat House development and onto Bramcote Road (Photo 4). The flood water overwhelmed the highway drainage system on Bramcote Road and breached the highway and property thresholds, resulting in extensive external property flooding and internal property flooding of five residential properties (reaching depths of two feet) and destroying several vehicles (Photo 5).

Photo 4: the route the flood water took during the flood event in dry conditions

Photo 5: the route the flood water took during the flood event.

Photo 6: Photos of the impacts of the flooding

4.3 POST FLOOD EVENT

Following the flood event, a community meeting was held for residents which the Council, CBC and the EA attended. The Council has also conducted a range of site visits and meetings and distributed additional questionnaires to gather further information on the nature and impacts of the event. The Council has reviewed and analysed all available data as part of this investigation. The following has been ascertained as part of the investigation:

- The Victorian footbridge caused a significant bottleneck to the flow of the Moat Brook as flood water backed up to Bramcote Road and Beck Crescent. The ground profile along this boundary created a flow route onto Bramcote Road (Photos 4 and 5).
- During the flood event, the flood compensation area filled quickly to capacity. Although the asset functioned as per its design, it did not act as a static storage area as expected by the residents (Figure 4). This water was observed flowing in the same direction as the Moat Brook (Photo 9), adding to the volume of flood water flowing towards the bottleneck and impacting residential properties.
- The Moat Brook and land drainage ditch had received limited maintenance leading up to the flood event which would have reduced their flow capacity. Of note are a tree stump covering a small cross section of the Victorian footbridge (Photo 7) and the substantial overgrowth of the land drainage ditch (Photo 8). Ultimately, due to the high volume of water this is likely to have had a negligible effect on the severity of the flooding.
- The moat feed system was completely inundated during the event with the land drainage ditch (Number 7, Figure 2) filling to the top and contributing to the amount of runoff entering the private parking areas and subsequently the residential properties.
- Residents noted that the Beck Crescent attenuation pond level waterline was low during the event and the flow control was working correctly. As such, the Beck Crescent surface water drainage system appeared to be running as designed with no issues or adverse impact on the flooding.

Figure 4: The flood extents and flow routes based off anecdotal reports.

Surface Water Flood Mapping

The Surface Water Flood Map (Figure 5) for the flood incident location indicates that there is a medium risk of flooding from surface water to the location. This data was produced by the EA and is created using high-level modelling which replicates where water would fall during certain rainfall events[1].The data does not however consider the changed ground levels following the construction of the Beck Crescent development.

[1] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

The output of Figure 5 does broadly depict what was witnessed on 1st October 2019 for the flood impact area, suggesting that the changes made to the local topography by the recent Beck Crescent development had a negligible impact on the flood extents and flow routes and that the properties on Bramcote Road are already considered to be at risk due to natural topography and pre-existing features.

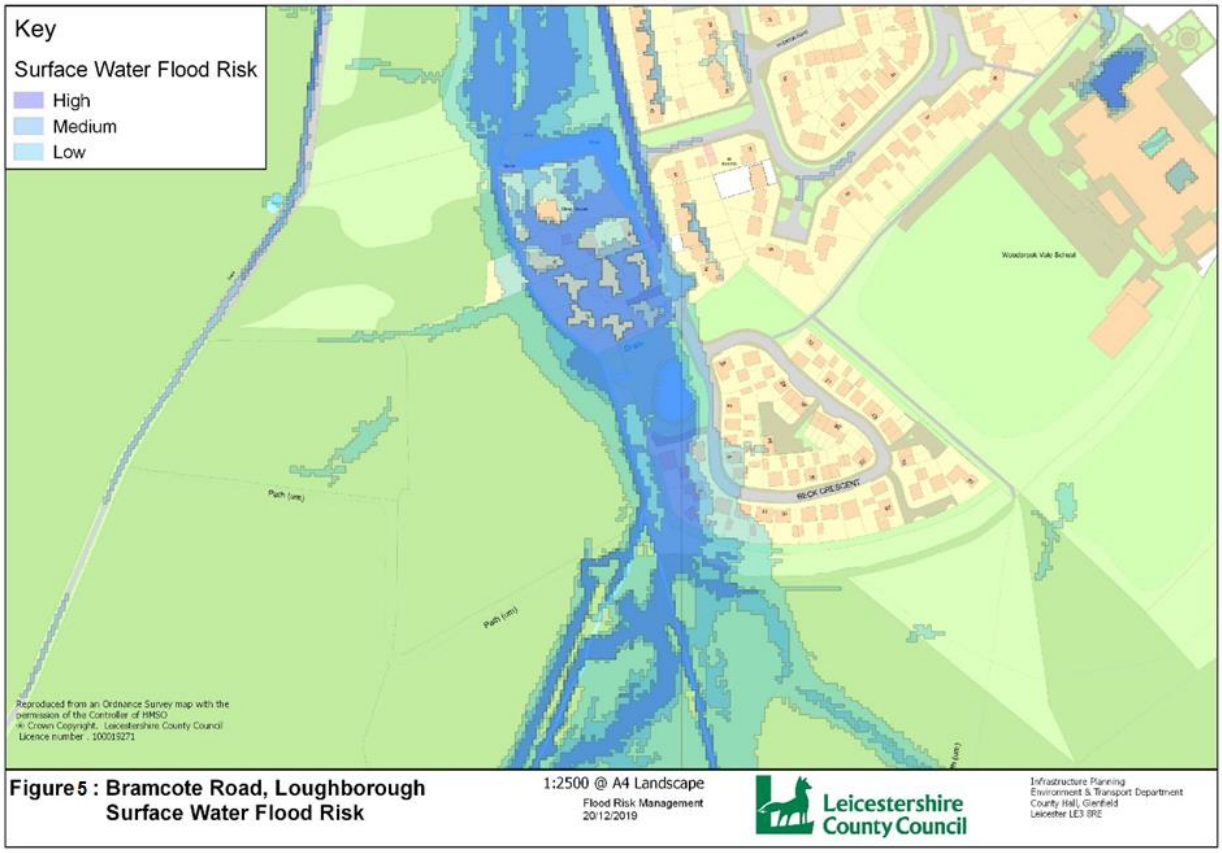


Figure 5: Environment Agency Surface Water Flood Map

The Wood Brook and the lower reaches of the Moat Brook are identified in the Charnwood Surface Water Management Plan (SWMP) as a Critical Drainage Area (CDA). The Wood Brook is channelised and culverted along much of its length, which has an impact on the Moat Brook's ability to discharge in high flow conditions (Photo 10). This therefore causes flood water to quickly back up the Moat Brook during heavy rainfall. This was witnessed during the flood event, where flood water from the Wood Brook backed up the Moat Brook as far as the south end of Moat Road. This led to a significant slowdown in the flow of water in the Moat Brook, further reducing the volume of water that could pass through the Victorian Foot Bridge. This further exacerbated the bottleneck and contributed to the flood water rerouting onto Bramcote Road.

The flood compensation area appeared to work as designed and provided significant benefit by providing online storage which allowed flood water to spread out. Video evidence shows that the water within the compensation area continued to flow towards the Victorian footbridge at a slower rate than the water in the Moat Brook. However, the compensation area is not designed to provide static storage of water and as such it did not alleviate the pressure on the Victorian Footbridge enough to prevent the flow backing up and eventually resulted in internal property flooding on Bramcote Lane. The complete removal of the Victorian foot bridge to remove the bottleneck is not feasible as the structure is part of the Moat House's Grade II listed status. Furthermore,

its removal would likely lead to a significant increase in flood risk to Loughborough downstream.

Photo 10: Typical example of the current condition of the Wood Brook and how it is a key throttle point

4.4 SUMMARY OF IMPACTS AND FINDINGS

The result of the combination of factors described below resulted in the ingress of storm flood water to five residential properties on Bramcote Road and the external flooding of nine residential properties on the 1st October 2019:

- Above average rainfall for the preceding months. The heavy rainfall event resulted in large quantities of water in such a short space of time that overwhelmed the already saturated local drainage networks.
- The Victorian footbridge restricted flow and caused water to back up the Moat Brook. The water backing up from the Victorian footbridge found the low point between Bramcote Road and Beck Crescent, creating a flow route from the Moat Brook onto Bramcote Road.
- The affected residential properties are located at a low point on the highway. The private driveways at Bramcote Road are at Highway level and the threshold levels of the affected residential properties that are situated off Bramcote Road are set at low levels. This allowed easy access of raised water from Bramcote Road into the residential properties.

There are many factors that may have exacerbated the impacts of the flood event. Whilst these factors may have made a difference to the volume and peak flood levels, at the time of writing this report, there is no firm evidence that these factors would have prevented any of the internal flooding experienced by this event.

- Although the highway drainage system was overwhelmed by the volume of water. It should be noted that it is not the purpose of highway drainage to intercept additional flows from other sources other than what falls on the highway itself. Therefore it should not be expected that the highway systems be able to prevent flood water entering and spreading from the highway.

- The flood compensation area has no formal control to attenuate the water. Although the feature was built to design and provided flood storage capacity during the event, it could be designed to hold the water and reduce the peak flow along Bramcote Road. There is potential to modify this area to provide greater storage volumes and be fitted with a flow control to gradually release flood water and reduce the peak stress on the Victorian footbridge.
- The flow of water through the Victorian footbridge was further hindered by an existing tree stump on the western bank adjacent to the Victorian footbridge opening; however the impact of this is considered negligible as the tree stump only obscured a small cross section of the culvert.
- The unmaintained section of the Moat Brook and land drainage ditch (Figure 2) would have reduced their flow capacity and subsequently added to the volume of overland surface water flow. Given the volume of water that fell during the event the impact of this is considered negligible.
- The channelised and culverted nature of the Wood Brook would have reduced the discharge rate of the Moat Brook. However, this would have had a minimal effect compared to the restrictive nature of the Victorian Footbridge and fast run-off of the upstream Moat Brook catchment.
- The impacted residential properties did not have any awareness of previous flooding to their residential properties. By considering the limited awareness and the speed of the flood water it can be presumed that there may have been limited personal preparation for the flood, thus exacerbating its impacts.
- Witnesses observed that some of the gullies on the Beck Crescent development appear to have been ineffectively placed to intercept the flow of water heading towards Bramcote Road. Video and photographic evidence confirms this but shows that the amount of water ultimately reaching Bramcote Road was insignificant.

5 RESPONSIBILITIES

5.1 LEAD LOCAL FLOOD AUTHORITY (LCC)

As the LLFA, the Council has the responsibility to co-ordinate the management of flood risk and the interaction of RMAs across Leicestershire.

The LLFA also has a responsibility to maintain a register of drainage assets which are considered to provide a significant role in the mitigation of flood risk (as detailed within Section 21 of the FWMA).

The register must contain a record detailing each structure or feature including ownership and state of repair. As the LLFA, the Council look for support and information from other agencies that are designated as RMAs to ensure any assets, which could potentially have a significant effect on flood risk, are recorded on the asset register.

As the LLFA, the Council has permissive enforcement powers related to ordinary watercourses within private ownership. The duty to maintain the ordinary watercourses on private land, however, rests with the relevant riparian landowner.

5.2 CHARNWOOD BOROUGH COUNCIL

Charnwood Borough Council has powers under Section 14 of the Land Drainage Act 1991 (LDA) to undertake flood risk management works on ordinary watercourses (excluding Main Rivers), where deemed necessary. Under Section 20 of the LDA, Charnwood Borough Council has the powers (by agreement of any person and at their expense) to undertake drainage work which that person is entitled to carry out and maintain.

5.3 HIGHWAY AUTHORITY (LCC)

As LCC has the role of local highway authority, they have a duty to maintain the Highway under Section 41 of the Highways Act (1980). Section 100 states that LCC also has the power to prevent water running onto the highway from adjoining land.

5.4 WATER COMPANY (SEVERN TRENT WATER)

Water and sewerage companies are responsible for managing flood risk related to surface water, foul water and combined sewer systems. Public sewers are designed to protect properties from flood risk in normal wet weather conditions. In extreme weather conditions however, there is a risk of these public sewers being overwhelmed resulting in sewer flooding.

Following the ‘Private Sewer Transfer’ on 1st July 2011, water companies are now responsible for all pipes systems on private land that serve more than one curtilage and are connected to a public sewer. Under Section 94 of the Water Industry Act

(1991) statutory sewerage undertakers have a duty to provide sewers for drainage of buildings and associated paved areas within property boundaries.

Water companies are responsible for all public sewers and lateral drains. Public sewers are a conduit (typically a pipe) assigned to a water and sewerage company that drains two or more properties, conveying foul, surface water or combined sewerage to a positive outfall. Connection of other drainage sources to public sewers is discretionary following an application to connect.

5.5 RIPARIAN LANDOWNERS OF WATERCOURSES AND HOMEOWNERS

As detailed within the Environment Agency document 'Living on the Edge', riparian landowners have certain rights and responsibilities including:

- They must maintain the bed and banks of their watercourse, including the trees and shrubs growing on the banks.
- They must clear any debris, even if it did not originate from their land. This debris may be natural or man-made.
- They must keep any structures that they own clear of debris. These structures include (but are not limited to) culverts, trash screens, weirs and mill gates.

All riparian owners have the same rights and responsibilities. These responsibilities include the requirement to "keep any structures, such as culverts, trash screens, weirs and mill gates clear of debris". However, "a landowner has no duty in common law to improve the drainage capacity of watercourse he/she owns."

- A full explanation of the rights and responsibilities of riparian ownership are given in the Environment Agency publication, "Living on the Edge".

Local residents and tenants who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected. Although work has been undertaken to provide properties with flood resilience, it should be noted that their properties remain at risk from similar or more severe storm events and communities should always be vigilant and proactive in seeking further resilience measures.

Community resilience is important in providing information and support to each other if flooding is anticipated. Actions taken can include signing up to Flood Warning Direct (if available), nominating a community flood warden, producing a community flood plan, implementing property level protection and moving valuable items to higher ground. More permanent measures are also possible such as installing floodgates, raising electrical sockets, and fitting non-return valves on pipes.

6 RECOMMENDATIONS/ACTIONS

6.1 LEICESTERSHIRE COUNTY COUNCIL (AS THE LEAD LOCAL FLOOD AUTHORITY)

The Council has agreed/completed the following actions:

ACTION	PROPOSED TIMESCALE
To continue to co-ordinate the actions of the RMAs and feedback to the community.	Completed
To work with residents and RMAs to ensure that riparian landowners are fully aware of their maintenance responsibilities for ordinary watercourses.	3 months from publication date
Consider adding private assets and the Beck Crescent Highway Culvert (Figure 2) onto the Council's flood risk asset register where appropriate.	6 months from publication date
Liaise with the residents of Bramcote Road and CBC to assist with setting up a flood action group and the creation of a Flood Warden Scheme in the neighbourhood should it be requested.	6 months from publication date
Consider further investigation into potential Natural Flood Management measures upstream or to make potential more effective use of the compensation area.	12 months from publication date
To continue to work in partnership with other RMA's to establish potential multi-agency flood and pollution mitigation projects along the Moat Brook catchment. This should include continuing to explore future potential flood alleviation schemes.	12 months from publication date

6.2 LEICESTERSHIRE COUNTY COUNCIL (AS THE LOCAL HIGHWAYS AUTHORITY)

The Council has agreed/completed the following actions:

ACTION	PROPOSED TIMESCALE
Review the current highway drainage regime in this area to determine the current level of maintenance undertaken and	Completed July 2021; P2

consider if the highway drainage network in this area can be a more regular maintenance schedule.	frequency (20 months)
Review the status and condition of the Beck Crescent Highway Culvert (Figure 2).	3 months from publication date
To continue to work in partnership with other RMA's to establish potential multi-agency flood and pollution mitigation projects along the Moat Brook catchment. This should include continuing to explore future potential flood alleviation schemes	12 months from publication date

6.3 CHARNWOOD BOROUGH COUNCIL

CBC has agreed/ undertaken the following actions:

ACTION	PROPOSED TIMESCALE
Liaise with the Beck Crescent developer to ensure the finished development and landscaping are correct and accurate to the documentation submitted to CBC as part of the planning application.	3 months from publication date
Liaise with the residents of Bramcote Road and the Council to assist with setting up a flood action group.	6 months from publication date
To continue to work in partnership with other RMA's to establish potential multi-agency flood and pollution mitigation projects along the Moat Brook catchment. This should include continuing to explore future potential flood alleviation schemes	12 months from publication date

6.4 ENVIRONMENT AGENCY

The EA has agreed/undertaken the following actions:

ACTION	PROPOSED TIMESCALE
To investigate the flooding that occurred on the Wood Brook to assess the impacts this had on the hydraulic performance of the Moat Brook.	12 months from publication date

To continue to work in partnership with other RMA's to establish potential multi-agency flood and pollution mitigation projects along the Moat Brook catchment. This should include continuing to explore future potential flood alleviation schemes	12 months from publication date
To consider adding the Moat Brook to its flood alert system where feasible.	9 months from publication date

STATUS OF REPORT AND DISCLAIMER

This report has been prepared as part of the Council's responsibilities under the FWMA.

The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

The opinions, conclusions and any recommendations in this report are based on assumptions made by the Council when preparing this report, including, but not limited to those key assumptions noted in the report, including reliance on information provided by others.

The Council expressly disclaims responsibility for any error in, or omission from this report arising from or in connection with any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation and the Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and any recommendations.

The Council does not accept any liability for the use of this report or its contents by any third party.